Swami Ramanand Teerth Marathwada University, Nanded.

Synopsis of Research topic

"Benthic Fauna of Major Aquatic Reservoirs in Relation to Soil and Hydrological Variables in Parbhani District"

Submitted for

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under the faculty of Science and technology,
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Submitted by

Mr. Kakde Shubhangi Parmeshwar

Under the guidance of

Dr. S M. Yeole,
Assistant Professor,
Department of zoology,
MSP mandals,
Shri Shivaji college, Parbhani, 431401(M.S.)

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Abstract of proposed work plan

"Benthic Fauna of Major Aquatic Reservoirs in Relation to Soil and Hydrological Variables in Parbhani District"

Introduction

Benthos refers to any organism that lives or inhabits the bottom areas of an aquatic environment. "Haeckel" first used the word "benthos" in 1891. In freshwater bodies, the term benthos refers to the organisms that live at the bottom of freshwater bodies of water including lakes, rivers, and streams.

There are numerous ways to categorize the benthos. For instance, all consumers are categorized as zoobenthos while primary producers are categorized as phytobenthos. Hyperbenthos refers to an organism that dwells above the sediment and epibenthic refers to species that reside on top of the silt. Because they are a major source of food, benthic organisms play a significant part in the aquatic ecosystem. Numerous species of organisms that span numerous phyla such as annelids, arthropods, and mollusks can be found in the benthos.

As consumers of plankton and sources of food for fish and shellfish that feed on the ocean floor, benthic organisms are a crucial part of the freshwater environment and play a significant role in ecology (Parulekar et al., 1980). They offer vital connections in the freshwater food chains between lower trophic levels and primary producers. Some have a significant economic impact on their own. The largest stable source of organic carbon in estuaries may be benthic invertebrates. Humans harvest oysters, blue crabs, and other varieties of clams, thus they are significant both commercially and recreationally.

Given their shape and function, benthos and polychaetes in particular have a significant impact on the ecology of freshwater communities. Only a tiny number of species are also crucial for commercial purposes. This is primarily due to the fact that they are used as live bait in the sea angling sector, which in certain developed nations is the single largest form of leisure participation. Since it has been discovered that polychaetes can provide a nutritionally correct balance of polyunsaturated fatty acids (PUFA), which are essential for egg maturation in cultured prawns

(Lytle et al., 1990), or can provide other factors essential for the same (Croz et al., 1988), polychaetes have grown in importance as a resource in relation to the development of global aquaculture for Crustacean.

The Yeldari Dam is an earthfill structure on the Purna River close to the village of Yeldari in the Indian state of Maharashtra. The Marathwada region's second-largest dam is located there. In Parbhani District, the dam has been restored and developed into a significant reservoir and tourist destination. The dam is 59.9km distance from our research center. The dam is 4,232 m (13,885 ft) in length and 51.2 m (168 ft) in height above its lowest foundation. The amount of live storage is 0.81 km3 (0.19 cu mi).

The Karpara (Nivali) Dam is an earthfill structure on the Karpara River in the Parbhani district of the Indian state of Maharashtra, close to Jintur. The dam is 44.5km distance from our research center. The dam measures 1,046 m (3,432 ft) in length and 16.66 m (54.7 ft) in height above the lowest foundation. The gross storage capacity is 27,320.00 km3 (6,554.42 cu mi), and the volume content is 344 km3 (83 cu mi).

To assess the health of the aquatic environment, including harbors, pollution monitoring programs have used benthos in this situation. Aquatic freshwater benthic animals developed from numerous phyla and comprise a diverse fauna. The distribution, population density, and variety of the benthic community are all directly impacted by the abiotic component of the water body. Benthic fauna are particularly important for aquaculture because they feed bottom-feeding fish themselves. Hence an attempt has been made to study the benthic faunal diversity and its interrelation with soil chemistry and various hydrological variables of yeldari and karpara (Niwali) reservoir of parbhani. Present study will help to assess the status of selected water bodies in term of nutrition and contamination combinations. In this context, we will assess monthly variation in water chemistry and qualitative-quantitative status of reservoir, Ta Jintur Dist Parbhani and compare the of selected water body with the of experimental set up.

Review of literature and Development in the Subject

(Previous work done in the relevant area)

Chhetry et al. (2004) studied the physico-chemical parameters like air temperature, water temperature pH, transparency, DO, free co2, alkalinity, chloride and BOD of the Titrigachhi Daha. Transparency, pH, total hardness, DO and total alkalinity were recorded maximum in winter season.

Bhattarai (1996) studied the physico-chemical environment and macro-invertebrates of Lami Lake of Royal Chitwan National Park. Water temperature, pH, conductivity, Total alkalinity, Total hardness, free carbon-dioxide, calcium, Magnesium, Nitrate etc of water sample of lake were made monthly and these were found normal range necessary for aquatic biota but most important parameter DO was found above the permissible level throughout the study period.

Thomas (1975) noted Chemical tests apply to the moment of Sampling. Both approaches i.e. Physico-Chemical and biological Parameters are necessary to define water quality.

Tamrakar (1996) conducted a physico-chemical parameters, distribution and abundance of zoobenthos in Manohara river for six months. The abundance and distribution of zoobenthos in relation to different sites were determined by correlating them with physico-chemical parameters of water

Burlakoti (2004) studied the physico-chemical characteristics of the water are of great significances for any aquatic life. Each species has certain tolerance level and reflex action towards particular type and content of physico-chemical parameters. The floristic and faunal diversity of wetland is influenced by several physico-chemical parameters such as water transparency, velocity depth, pH, nutrients etc.

Neku (1997) studied the effect of physico-chemical parameters and distribution of some benthic macro-invertebrates of Vishumati river. The composition of macro-invertebrates and physico-chemical parameters of the river indicates that the water of the Vishumati river was polluted. During the study period group of animals such as Annelida, Mollusca and Arthropoda phyla were recorded.

Sharma and Nath (1997) studied the effect of physico-chemical factors on benthic fauna of Bhagirathi River. He observed the lowest DO in August and the highest in January. The highest value of benthic fauna was recorded in February and lowest in July and August. He found insect

population 96% of the total population. Among insects Coleoptera, Diptera, Ephemeroptera, Hemiptera, Odonata, Plecoptera, and Trichoptera Contributing 12.18, 0.26, 47.93, 1.29, 11.14 and respectively. The maximum in abundance of lotic benthos was observed in winter and early summer phase of water current, riverine, temperature, high content of DO and clarity of water during these months.

Shrestha (2007) studied the faunal diversity and water quality in the Trishuli river water shed at Kurintaar in the study period, three stations (Pandure Khola of Thaguware VDC, Dharapani and riverside spring) were taken for detection of water quality of spring water. The physico-chemical parameters like temperature, pH, conductivity, total alkalinity, total hardness, calcium, magnesium, nitrate and orthophosphate had no parameters of water indicated that the spring water of the study sites was unpolluted.

Objectives of Research

- Benthic fauna should be classified as useful, harmful, and neutral.
- To conduct in-depth research on the benthic fauna of specific water bodies at the highest taxonomic level
- To estimate different soil and hydrological factors, such as pH, nutrients, etc
- To make a suggestion about the relationship between specific soil and water factors and benthic fauna
- To research the morphometry of particular water bodies.
- To statistically analyze the data collected in order to get a reliable conclusion

Methodology to be adopted:

Various nets, grabs, and core samplers were used to gather benthic samples. In between 8am to 10 am the collection of bottom mud procedure will be made, The samples were gathered during a 12-month period and the average value of the data will calculated. The sample is transferred to a bucket and its volume is calculated. The suspension method which involve filtering through the sieve of various sizes was used to separate the organism in the samples. Aquatic life was observed floating on the surface and will be caught using forceps and a net. In an enamel tray, the filtered residue is put before being mixed with sugar solution. Additionally, formaldehyde is essential to the aquatic biodiversity. The binocular microscope and Bullen were employed to determine the

lowest taxonomic categorization, we located and counted the forms with the aid of common keys organism identification up to the species level was completed.

Mud samples were obtained with the aid of a quadrate that was 20cm by 20cm in size for the study of benthic fauna, soil, and water analysis. With the aid of a shovel the mud from this quadrate was removed and placed to the appropriate level of polythene bags. The samples will be brought to the lab for benthic fauna analysis.

The standard methods provided by APHA (1989) and Ramesh and Anbu (1996) will be used to measure various soil parameters, such as nutrients, pH, and hydrological parameters, such as temperature, transparency, pH, TDS, TS, Hardness, chlorides, dissolved oxygen, free carbon dioxide, nutrients, etc., on a monthly basis.

While identification will be done using the standard keys and monographs provided by Edmondson (1959) and APHA (1989), mud samples for the observation of benthic fauna will be carried out using the standard procedures and samplers offered by APHA (1989). On a fortnightly basis, samples will be collected to observe the benthic fauna.

We may adopt any other standard methodology for sample collection and standard literature for the identification of recorded benthic fauna as if required.

Importance of study

International status

The relevance of the biodiversity of microorganisms in various hosts and in the environment has only lately been acknowledged (Thompson et al., 2017), in contrast to the long-standing appreciation of the biodiversity of higher plants and animals (Larsen et al., 2017). The need for documentation of biodiversity across the Earth's living systems has increased due to its reduction as a result of anthropogenic influences (Johnson et al., 2017; Mihoub et al., 2017; Veresoglou et al., 2015). Biodiversity is crucial for ecosystem functioning (Loreau et al., 2001). The biodiversity of microeukaryotes, especially those found in freshwater settings, hasn't been thoroughly studied yet (Cazzolla Gatti, 2016; Leray & Knowlton, 2016; Xiong et al., 2021). Freshwater covers only

0.8% of the land surface and accounts for only 0.01% of all water on Earth, but it harbors ~6% of all de- scribed species (Dudgeon et al., 2006; Gleick, 1996).

According to Lampert and Sommer (2007), littoral sediment is frequently patchy and varies in terms of grain size, macrophyte coverage, and levels of organic content. Additionally, periphyton covers hard substrates in the littoral that are exposed to environmental changes, such as the surfaces of stones. In addition to dead organic matter and heterotrophic elements including bacteria, fungus, protists, and small metazoans, it primarily consists of algae (Weitere et al., 2018; Wetzel, 2001). The profundal zone, on the other hand, is a relatively stable environment with a steady temperature and homogeneous sediment composition. It is defined as the region receiving less than 1% of photosynthetically active sunlight (Martens, 1994; Rundle et al., 2002). Specific communities are typically established as a result of these variations in the stability and complexity of the habitats (Mougi & Kondoh, 2012; Wilden et al., 2020).

National status

With a land mass of 32, 87,590 square kilometers, India is the seventh largest nation in the world. It is located to the north of the equator between 6° 45' (the southernmost point, Indira Point in the Great Nicobar Islands of Indian territory) and 37° 6' north latitude and 68° 7' and 97° 25' east longitude. In its many diversified ecosystems and habitats, which are dispersed in various yet distinctive biogeographic zones, India is blessed with extraordinary biodiversity. Its biodiversity diversity is strongly expressed in the fauna of both freshwater and marine aquatic environments, in addition to terrestrial ecosystems. India is one of the seventeen countries with the highest levels of mega biodiversity that are currently known to exist, and it ranks ninth in the world for freshwater mega biodiversity (Mittermeier et al., 1997).

The freshwater habitats of India include all varieties of inland wetlands, such as bogs, marshes, and swamps, as well as lakes, rivers, ponds, streams, groundwater, springs, cave waters, and floodplains. 4% of the world's freshwater resources are found in India, a country with 2.4% of the world's territory (source: the Ministry of Water Resources, Government of India). There are 29,000 km of rivers, 3.15 million hectares of reservoirs, 2.35 million hectares of ponds and tanks, 0.2 million hectares of floodplains, and 33 wetlands among the region's substantial water resources, according to Ayyappan (2007). The 14 major rivers and their tributaries, several minor/small

rivers, rivulets, and streams, 44 medium reservoirs and lakes, and other tiny waterbodies make up the primary freshwater systems.

A sizable amount of India's total biological diversity, including the majority of the taxonomic groups, is supported by freshwater ecosystems. Around 9.7% of all Indian fauna is linked to the country's watery environments. The phylum Arthropoda alone accounts for 5923 species, or roughly 62.6%, of the 9456 freshwater animal species from India that are known. With 4842 species, insects (of 9 orders) make up the majority (51.2%). 8.7% of all freshwater species belong to the varied Arthropod group Crustacea (822 species). The phyla Mollusca (217 species) and Annelida (167 species) are moderately diverse, accounting for 2.3% and 1.8% of all freshwater species, respectively. 1.7% of the total comes from the 163 species of Platyhelminthes (Turbellaria 47 species + Cestoda 116 species). 1597 species (16.9%) of the phylum Chordata, which includes the vertebrates, are represented. The largest of them is Pisces (Fishes), with 1027 species, followed by Amphibians (275 species) and Aves (birds), with shares of 10.9%, 2.9%, and 2.6% of all freshwater fauna, respectively. The number of species known from India's freshwater systems belongs to the families of reptiles (46 species) and mammals (6 species) and is relatively lower

Significance of the study

Benthic fauna contributes significantly to the ecosystem’s food chain by providing food for larger animals like fish and connecting primary tropic level to higher trophic levels. They serve a crucial function in decomposing organic matter prior to bacterial demineralization as well as structuring and oxygenating this bottom by reworking sediments. In addition some benthic animals particularly clams are consumed by humans while others like worms are used as bait for amusement. Benthic communities are frequently used as biological indicators. These features include exposure to low dissolved oxygen levels that frequently occur near the bottom surface due to organic matter degradation, their diversity in taxonomy and function enables the detection of many forms and levels of stress. According to bioclimatic area the kind of ecosystem and specific characteristics of the environment in which the organism resides such as bottom water salinity, water renewal rate and sediment type, benthic communities composition, variety, and vigor also naturally vary. Benthic communities are abundant in aquatic settings and play a significant part in sustaining the food chain and primary production (Alongi and Christoffersen,1992). Hence research on benthic communities is crucial for effective resource management.

The present study will provide the data about soil chemistry, water chemistry and benthic faunal diversity of Yeldari and Karpara (Niwali) reservoir and can suggest the status of water bodies. This study will also help to formulate any correlation between various selected variables and benthic diversity. Fundamental data of benthic diversity can be used for better management practices of the selected water bodies and can be applicable to other similar aquatic habitats.

Proposed Work Plan / Year wise plan

1ST YEAR – Preparation of course work examination and selection of research topic.

2nd YEAR – collection of data of water chemistry and diversity of benthic fauna from both the selected water bodies**.**

3rd YEAR – Forming an inter-relation between water chemistry, soil chemistry and benthic faunal diversity, through standard literature and references. Interpretation of data in statistical way.

4th YEAR – Compilation of data and submission of thesis.

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Research Scholar
(Miss. Shubhangi P. Kakde)

Research Supervisor